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HOODOO CREEK
(tributary to Hoodoo Lake)

Waterbody Type:	stream
Ecoregion:	Northern Rockies
Designated Uses:	none; existing uses are agricultural water supply, primary and secondary contact recreation, cold water biota and salmonid spawning.
Size of Waterbody:	10.6 miles of stream
Size of Watershed:	26,900 acres

Summary: Hoodoo Creek is a third order stream draining into the Pend Oreille River above the Albeni Falls dam of north Idaho. In 1996, Hoodoo Creek was placed on the 303(d) listed due to sediment and thermal pollution. The results of DEQ's waterbody assessment process indicate that the stream is not fully supporting its designated beneficial uses. A target load for sediment was established at 1,012.7 tons/yr from the existing load of 6,150.9 tons/yr. Temperature will not be addressed at this time due to anticipated change in Idaho's temperature standard.

1. Physical and Biological Characteristics

Approximately 12 miles above Albeni Falls Dam and nine miles southwest of Sandpoint, Idaho, Hoodoo Creek flows into the Pend Oreille River. The Hoodoo Creek drainage contains 26, 900 acres (106 km^2) used primarily for forestry, agriculture, and small acreage rural residences. The watershed is underlain by alluvial and glacial deposits, granitics of the Kaniksu Batholith, and a minor outcropping of Precambrian metasedimentary rocks. The landforms in Hoodoo Creek are strongly influenced by the glacial Lake Missoula floods. Lower elevation landforms are glacial flood terraces with some fluvial erosion patterns imposed. Alluvium and glacial flood deposits dominate a wide band along the creek. The uplands in the eastern half of the watershed are eroded and rounded irregularly as a result of the Lake Missoula flood.

The Hoodoo Creek watershed drainage is oriented in a northerly direction with the creek generally flowing from the south to the north. Elevation ranges from 2080 feet (634 m) at the mouth to 2460 feet (750 m) at the headwaters. Due to the effects of the Lake Missoula flood the Hoodoo Creek watershed has a poorly developed drainage system with most of the tributaries running subsurface before entering the main channel.

Moderately cold winters and cool, dry summers characterize the area. Average annual precipitation ranges from 25 to 30 inches (63.5 to 76.2 cm). The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation. Lower elevations are dominated by Lodgepole flats and wetland meadows. The uplands are mostly cedar hemlock vegetative types. Very wet areas support alder, willow, and other water loving species. Forestry is currently

being practiced on 21,457 acres (86.8 km^2) or about 82% of the watershed.

2. Pollutant Source Inventory

Point Source Discharges

There are no permitted point source discharges in the Hoodoo watershed.

Nonpoint Source Discharges

Sediment generated from roads, skid trails, and mass wasting was evaluated for delivery to streams. The Hoodoo Creek drainage contains approximately 245 miles of roads. Based on the weighted average score for the forestry portion of the watershed, the sediment delivery rating from FPA roads is low, reflecting mostly road surface and inside ditch erosion but little delivery to stream channels.

2a. Summary of Past and Present Pollution Control Efforts

Unknown.

3. Water Quality Concerns and Status

The Hoodoo Creek beneficial uses are agricultural water supply, primary (Sue Ahlers, personal communication, 1994) and secondary contact recreation, cold water biota and salmonid spawning (John Hollister, personal communication 1999).

3.a. Applicable Water Quality Standards

Hoodoo Creek was listed for sediment and thermal pollution in the 1996 303(d) list. The Idaho Water Quality Standards narrative criteria (IDAPA16.01.02.200) states that sediment shall not exceed, in the absence of specific sediment criteria, quantities which impair designated beneficial uses.

The numeric criteria (IDAPA 16.01.02.250) for temperature to protect salmonid spawning shall be 13°C or less with a maximum daily average no greater than 9°C. Temperature exceedances will not be addressed until proposed new temperature standards have been finalized.

3.b. Summary and Analysis of Existing Water Quality Data

See the Cumulative Watershed Effects Summary Report found in Appendix B. Results of the 1998 Beneficial Use Reconnaissance monitoring was an Macrobiotic Index score of 2.6, a Habitat Index score of 52 and electrofishing which found no salmonid species. The determination was that it does not fully support beneficial uses.

3.c. Data Gaps for Determination of Support Status

None.

4. Conclusion of Problem Assessment

Hoodoo Creek is impaired due to excess sediment load in the stream. A TMDL should be written to address this problem.

5. TMDL- Loading Analysis and Allocation

Problem Statement:
Excess sediment is impairing the beneficial uses of cold water biota and salmonid spawning in Hoodoo Creek.

5.a. Numeric Targets
(see attached spreadsheet)
5.b. Source Analysis
(see attached spreadsheet)
5.c. Linkage Analysis
(see below)
5.d. Allocations
(See attached spreadsheet.)

5.c. and 5.e. Monitoring Plan and Linkage Analysis

Because Idaho's Water Quality Standard for sediment is narrative and not based upon something directly measurable in the water column, a different approach is required to achieve a satisfactory monitoring plan. An analysis of the methods available for monitoring the success of TMDLs indicates that, in this case, more than one method should be used to verify the cause of the impairment, track load reduction, and to show that the stream is moving towards full support. The sediment monitoring plan will include three parts:

1. Determination of support status using Beneficial Use Reconnaissance monitoring. If the conclusion of the survey is no impairment for two surveys taken within a five year time period then the stream can be considered restored to full support status.

2. Load reduction measures shall be tracked and quantified. For example, 1.2 miles of road obliteration near a stream, 0.5 miles of stream bank fenced, 5 acres of reforestation, etc.

3. Amount of sediment reduction achieved by implementation of load reduction measures shall be tracked on a yearly basis. For example, 1.2 miles of road obliteration will result in a 6 tons/yr reduction, 0.5 miles of stream bank fenced

will result in a 3 ton/yr reduction, 5 acres of reforestation will result in a 0.7 ton/yr reduction, etc.

The reason for this three-part approach is the following:

1. DEQ presently uses the Beneficial Use Reconnaissance data to indicate if the stream is biologically impaired. Often times this impairment is based upon only one Reconnaissance survey. The survey should be repeated to insure that the impairment conclusion is correct and repeated twice after implementation to determine if the (improved) support status conclusion is correct. Survey data may show an impairment in fisheries or macroinvertebrates and the cause of the impairment may point to sediment pollution. However, there is not a direct linkage between the pollutant and the impairment. Sediment could be indicated as the problem when, in fact, temperature might be the problem. The Reconnaissance data is not specific as to the cause, just that there is a problem. So using the Reconnaissance data alone to monitor the TMDL is not adequate.

2. There is great uncertainty about how much sediment actually needs to be reduced before beneficial uses are restored. These TMDLs use a very conservative approach, in that the sediment target is limited to natural background amounts. However, beneficial uses may be fully supported at some point before this target is achieved. Therefore, a measure of sediment reduction cannot be used exclusively to determine a return to full support.

3. Because TMDLs are based upon target loads measured in a mass per unit time there must be a method included to directly measure load reductions. Coefficients, which estimate sedimentation rates over time based upon land use, have been used to develop the existing loads. This same method can be used for land where erosion has been reduced. Road erosion rates are based upon the Cumulative Watershed Effects road scores. These scores can be updated as road improvements are made and the corresponding load reduction calculated.

5.f. Margin of Safety

Because the measure of sediment entering a stream throughout the entire watershed is a difficult and inexact science, assigning an arbitrary margin of safety would just add more error to the analysis. Instead, all assumptions made in the model have been the most conservative available. In this way, a margin of error was built into each step of the analysis. Explanations of some of the values have not been detailed as yet on the spreadsheets pending their revision. Background loading from land uses and stream bank erosion coefficients are being revised to be specific to the Pend Oreille watershed. Once the revised values are received the "Sediment Yield" portion of the spreadsheet will more fully explain the source of the values. For an explanation of how the Cumulative Watershed Effects data was collected and processed, refer to the Idaho

Department of Lands manual titled, "Forest Practices Cumulative Watershed Effects Process For Idaho". One important detail to note when looking at how the Cumulative Effects data was used in the TMDL is that, although all forest roads in the watershed were not assessed, the field crews are directed to assess the roads most likely to be contributing sediment to the stream. This weighted the average road scores towards the ones most likely to be in poor condition.

References

Ahlers, Sue 1994. Personal communication regarding concerns for her children playing in Hoodoo Creek. Resident of/or near Vay, Idaho.

Dechert, T., Raiha, D. and Saunders, V. 1999. Hoodoo Creek Cumulative Watershed Effects Assessment. September. Idaho Department of Lands. Coeur d'Alene, Idaho.

Hollister, John. 1999. Personal communication concerning brook and brown trout presence in Hoodoo Creek. Resident of/or near Vay, Idaho.

Hoodoo Creek: Land Use Information

Land Use		***Explanation/Comments***
Sub-watershed	Hoodoo Ck	
Pasture (ac)	**4744**	
Forest Land (ac)	**21457**	
Unstocked Forest (ac)	**3442**	Includes once burned areas
Highway (ac)	0	State or County Paved Highways
Double Fires (ac)	**699**	Areas which have been burned over twice

Road Data		
Sub-Watershed	Hoodoo Ck	
1. Forest roads (total miles)	**118**	
CWE road score (av)	19.5	
*Sediment export coefficient (tons/mi/yr)	**4.5**	
#Total Forest Rd Failures (cubic yds delivered)	0	*Cumulative Watershed Effects data*
2. Unpaved Co.& priv. roads (total miles)	**118**	
Paved Co.&priv. roads (total miles)	10	
**Sediment export coefficient (tons/mi/yr)	**25.5**	
##Total C&P Rd Failures (cubic yds delivered)	0	*Based on weighted average of forest road failures.*

##Stream bank erosion-both banks (mi)		***erosion coefficients*
poor condition	**7.25**	*166.3 tons/yr/mi*
good condition	**5.0**	*51.7 tons/yr/mi*

*McGreer et al. 1997

**Stevenson 1996. Recommends 7 tons/ac/yr for unsurfaced roads X 3.64 ac/mi road = 25.5 tons/yr/mi

#Total road failures are the amount of sediment observed by the CWE crews that was delivered to the stream. This amount is used to represent the yearly delivery to the stream. This is an over-estimate of sediment delivered to the stream since failures can continue to deliver to the stream for a number of years after they occur, however, in a much reduced quantity. One much also take into consideration that all failures were not observed, which is an under-estimate of delivered sediment. These two factors combined with on-site verification by a

largest failures which probably occurred during the floods of 1996.

##Source of data from 1996 aerial photos.

Hoodoo Creek: Sediment Yield

Sediment Yield From Land Use Watershed:	Hoodoo Ck	*Explanation/Comments* *Acres by Land Use X Sediment Yield Coefficient = Tons Sediment/yr* *Yield Coeff. (tons/ac/yr)*
Pasture (tons/yr)	260.9	*0.055*
Forest Land (tons/yr)	815.4	*0.038*
Unstocked Forest (tons/yr)	58.5	*0.017*
Highway (tons/yr)	0	*0.034*
Double Fires (tons/yr)	11.9	*0.017*
Total Yield (tons/yr)	**1146.7**	*(Values taken from WATSED and RUSLE models see below explanation [#])*

*Sediment Yield From Roads Watershed:	Hoodoo Ck	
Forest Roads (tons/yr)	**531.0**	*Miles Forest Rd X Sediment Yield Coeff. from McGreer Model*
Forest Road Failure (tons/yr)	0	***Assumes soil density of 1.5 g/cc and a conversion factor of 1.26.*
County and Private Roads (tons/yr)	**3009.0**	
Co. and Private Road Failure (tons/yr)	0	

*Percent fines and percent cobble of the Hoodoo series B & C soil horizons is 100% fines, 0% cobble (Bonner Co. Soil Survey).
**"Guide for Interpreting Engineering Uses of Soils" USDA, Soil Conservation Service. Nov. 1971.
#Land use sediment yield coefficients sources: Pasture (0.055) obtained from RUSLE with the following inputs: Erosivity based on precipitation; soil erodibility based on soils in the watershed; average slope length and steepness by watershed; plant cover of a 10 yr pasture/hay rotation with intense harvesting and grazing; and no support practices in place to minimize erosion.
Forest Land (0.038) obtained from WATSED with the following inputs: landtype and watershed size
Unstocked Forest (0.017) obtained from WATSED with the following inputs: Acreage of openings, landtype and years since harvest.
Highways (0.34) obtained from WATSED with the following inputs: Value obtained from the Coeur d'Alene Basin calculations.
Double Fires (0.017) obtained from WATSED with the following inputs: Acreage, years since fire and landtype.

Hoodoo Creek Watershed: Sediment Exported To Stream

	Hoodoo Watershed
Land use export (tons/yr)	1146.7
Road export (tons/yr)	3540.0
Road failure (tons/yr)	0
Bank export (tons/yr)	
poor condition	1205.7
good condition	258.5
Total export (tons/yr)	**6150.9**
*Natural Background Mass Failure (tons/yr)	0

*Background mass failure is the difference between the total mass failure by geologic type, and the mass failure attributable to roads.

Hoodoo Creek Watershed

	Acres	Yield Coefficient (tons/ac/yr)	Background Load (tons/yr)
Total Watershed	26201		
Presently Forested	21,457		
Estimated Historically Forested	25,201	0.038	957.7
Estimated Historically Pasture	1,000	0.055	55
*Natural Mass Failure (tons/yr)			0
Background Load = Target Load		**Target Load**	**1012.7**
		Existing Load	**6150.9**
		Load Reduction	**5138.2**

X. **PEND OREILLE RIVER**
(Tributary to the Columbia River)

Summary: The Pend Oreille River was added to the 1996 303(d) list based upon a 1988 report from Idaho Fish and Game. Pollutants of concern are sediment, thermal modification and flow. Data from various studies point to the Albani Falls dam as the primary cause of: (1) sedimentation due to de-stabilization of river banks from water level fluctuations; (2) flow modifications due to the impoundment of water behind the dam; and (3) to an unknown degree, temperature increases due to the retention of water upstream of the dam and an increase in lake surface area. Preliminary findings of one study indicate that high temperatures in the Pend Oreille River are a natural condition. Short of removal of the Albani Falls dam, no scientific studies point to other more recent causes of sedimentation and temperature pollution. Idaho DEQ is not addressing flow as a pollutant. Due to the lack of a beneficial use assessment method for this type of river system it is difficult to determine its support status.

1. Physical and Biological Characteristics

The Pend Oreille River begins at the outlet of Pend Oreille Lake and drains 24,200 square miles (62,678 km²). Flows range from 11,200 to 73,000 cubic feet per second. The basin's topography consists of river-bottom flatlands in a long and narrow trough between the Selkirk Mountains and the Okanagan Highlands. Agriculture on the lowland plains includes grain crops, hay, pasture, and livestock. Soils in the floodplain are poorly drained to excessively drained on alluvial fans, terraces and dunes. Upslope of the river, the terrain is rolling to very steep with rock outcrops, and very deep well drained soils (Weisel 1982).

Albani Falls Dam was built on the Pend Oreille River in 1952, about 26 miles downstream from where it leaves Pend Oreille Lake. The dam significantly influences water levels in the lake and Pend Oreille River. During the summer months, the dam holds the lake level artificially high, and the Pend Oreille River downstream of its mouth essentially becomes a shallow outlet arm of the lake. During the fall the gates are opened at Albani Falls and water level is drawn down for flood control storage (Corsi *et al.* 1998). Presence of the dam altered the river substrate, which historically was deep holes and runs with cobble and gravel. This type of bottom substrate provided spawning habitat for salmonids, and before the dam, the river provided good cutthroat and rainbow trout, bull trout and mountain whitefish sportfishing (DuPont, 1994). When the dam was constructed, riparian vegetation was cleared to prevent excessive debris from entering the water during flow changes. This increased erosion and deposition of silt in gravel bars.

Today, the river shorelines have gentle to moderate steepness consisting of mostly fine sediments (<4mm), while about 10% consist of boulder and rip rap. The river has an average depth of 23.3 feet (7.1 m), a maximum depth of 159 feet (48.5 m), and an average width of 2,300 feet (700 m). Much of the Pend Oreille River watershed is privately owned with a concentration of homes along the river frontage. Based upon conservation officer reports, few people fish the river and

catches of salmonids (trout) and centrarchids (panfish, bass, etc.) are rare (DuPont, 1994).

2. Pollutant Source Inventory

Point Source Discharges

a. The Sandpoint Wastewater Treatment Plant discharges treated wastewater to the Pend Oreille River near Memorial Park just west of the Highway 95 "long" bridge across the lake. This plant is permitted to discharge on a weekly average: 550 lbs/day of biochemical oxygen demand, 550 lbs/day of total suspended solids, 200 colonies/100ml of fecal coliform bacteria, and a monthly average of 0.45 mg/l total residual chlorine.

The City of Sandpoint has problems with the infiltration/inflow of stormwater into their collection system. This causes the plant to periodically discharge only primarily treated wastewater (primary clarifier plus chlorine contact chamber) to the river. They exceeded their permitted effluent limits for all years examined, 1984-1998 (DEQ Inspection Reports). In 1998, the Environmental Protection Agency fined the City of Sandpoint $27,500 for violations involving the wastewater treatment plant's discharges.

b. The City of Priest River has been discharging treated wastewater to the Pend Oreille River since 1954. In 1998, EPA conducted an inspection of the facility and outlined major and minor problems the City must address. A review of the treatment plant's discharge monitoring reports indicates that the plant has been operating within permit limits. Prior to the 1998 inspection, the Priest River treatment plant was last inspected in 1987.

Due to growth pressures the City has begun plans to expand and upgrade their treatment plant. Upgrades will improve the reliability of the plant to meet permit effluent limits. The new system is expected to be operational by the year 2001.

c. The Albani Falls Dam has a small wastewater treatment system which serves facilities for its employees and visitors. The discharge was last permitted in 1978 and last inspected in 1983. A review of discharge monitoring reports indicates it is operating within its permit limits (DEQ NPDES files).

d. The City of Dover had requested EPA to permit a discharge of treated wastewater into the Pend Oreille River. The EPA, experiencing a backlog of NPDES permits to process, issued a "minor letter" which stated that the discharge is acceptable but must meet state water quality standards. The EPA later agreed to issue a discharge permit for the outfall sometime in the future. No public involvement process was solicited by EPA concerning this decision to permit the discharge. It is illegal to discharge wastewater in Idaho without a federal NPDES permit (Nickie Arnold, EPA, personal communication) .

The project is continuing forward and will begin discharging to the Pend Oreille River by

January, 2000. Other options in lieu of a discharge to the river were explored by the City but abandon. Land application of wastewater was one of these alternatives, but due to an objection by a resident this alternative was dropped (DEQ-Dover wastewater file).

Nonpoint Source Discharges

Due to a high population growth rate in Bonner County, the shoreline along the Pend Oreille River is now developed with primarily year around homes with shoreline riprap to prevent bank erosion. Much of the remaining native riparian vegetation left after the banks were stripped of trees for the dam operation, have been replaced with lawns and rock rip-rap for bank stabilization. Water level fluctuations of the Albani Falls dam prevent the establishment of vegetation in the flooded zone, which results in severe bank erosion along undeveloped shoreline.

2. a. Summary of Past and Present Pollution Control Efforts

Most of past research on the Pend Oreille River has been conducted downstream of the Albani Falls Dam, and primarily focused on the severe Eurasian milfoil infestation and how to get rid of it (EPA 1993). In 1998, Eurasian milfoil was first discovered in the river upstream of the Albani Falls Dam. Historically, the dam has operated as a barrier to the upward migration of this invasive non-native aquatic plant. This discovery of the plant above the dam marks the beginning of Idaho's fight to minimize milfoil's spread further upstream to the mouth of the river, and into Pend Oreille Lake, Priest River, and Priest Lake. Thus far, Bonner County's response has been swift and aggressive in treating the infested areas with herbicide.

3. Water Quality Concerns and Status

The Pend Oreille River was first listed in the 1988 Idaho Water Quality Status Report as fully supporting all beneficial uses, however, salmonid spawning, cold water biota and domestic water supply were noted to be potentially at risk. Pollutants of concern were nutrients, siltation/sedimentation, pathogens (bacteria) and other habitat alterations. The highest magnitude of pollution was attributed to flow regulation by the dam and its destabilizing effect on river banks and alteration of river hydraulics. To a lesser degree land development, wastewater discharges and septic systems were the sources of nutrients and pathogens. Forest practices and agricultural practices were of low magnitude of pollutant sources (DEQ, 1989).

Information in the 1988 report was based upon comments from Idaho Fish and Game and was transferred to the 1992 Water Quality Status Report without additional assessment. The 1992 list, in part, was then used to develop the 1996 303(d) list of impaired waters requiring TMDLs (DEQ, 1992). The pollutants of concern on the 1996 list are sediment, thermal modification and flow (DEQ, 1997).

The 1998 303(d) list adds total dissolved gas to the 1996 pollutants of concern, as a result of relicensing studies conducted by Washington Water Power (Avista). Dissolved gas in the river

will be addressed at a future date after the required TMDLs are completed.

3. a. Applicable Water Quality Standards

The pollutants of concern are regulated by the following Idaho Water Quality Standards:

Sediment
Idaho's water quality standard for sediment is narrative, and states that sediment shall not exceed quantities which impair designated beneficial uses. Designated beneficial uses for the Pend Oreille River are domestic water supply, agricultural water supply, cold water biota, and primary and secondary contact recreation.

Flow
The water quality standards do not include flow as a beneficial use, nor are there criteria to protect flow in a stream. Idaho's Antidegradation Policy states that, "The existing in stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." This might imply that flow is also regulated since it is necessary for the maintenance of existing uses. The State of Idaho, Division of Environmental Quality has taken the position that Idaho does not regulate water flow and therefore, it will not be addressed in this problem assessment.

Thermal Modification (temperature)
The Pend Oreille River is not protected for salmonid spawning or bull trout spawning and rearing (EPA, 1997). Therefore, only the cold water biota temperature standard applies and limits the river to a water temperature of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C (IDAPA 16.01.02.250.02.c.).

Because the Pend Oreille River flows into Washington, Idaho must insure that water quality of the river meets Washington's water quality standards at the border. Washington has designated the Pend Oreille River at the point it leaves the state of Idaho as a Class A water with the following special condition:

> "Special condition - temperature shall not exceed 20.0°C [68°F] due to human activities. When natural conditions exceed 20.0°C [68°F], no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C [32.5°F]; nor shall such temperature increase, at any time, exceed t=34/(T+9)."

Class A (excellent) waters in Washington are described as having water quality that shall meet or exceed the requirements for all or substantially all uses (WAC 173-201A-030).

3. b. Summary and Analysis of Existing Water Quality Data

In 1985, in response to a complaint, DEQ conducted a water quality analysis of the Pend Oreille

River in the vicinity of Riley Creek, near the town of LaClede. Temperature data from this survey was recorded for the months of April, July, August and September in 1985 and 1986. At the depth of 16.4 feet (5 m) the maximum temperature recorded was 21.3°C (70°F). A strong thermocline was exhibited during all ten sampling runs. The instantaneous temperature standard of 22°C (72°F) was not exceeded in any of the samples (Figure 1.).

Total suspended sediment and turbidity were also recorded during this investigation. Turbidity ranged from 9.0 to 0.1 NTU, with an average of 1.8 NTU. Total suspended solids were below the detection limit of 2.0 mg/l.

In 1987, due to concerns and complaints of the growing presence of algae and water weeds in the Clark Fork-Pend Oreille basin, Congress directed EPA to conduct a comprehensive water quality study of the entire basin. In response to this directive, a number of studies were initiated. The one specific to the Pend Oreille River is described below.

The Washington Department of Ecology, in 1988 began to address these concerns by conducting a study of water quality in the Pend Oreille River between Albeni Falls and Box Canyon dams. As a part of this study, surface water temperatures were taken every three weeks at Newport. Temperatures were below Idaho standards (22°C) but above Washington standards (20°C). Results of this sampling are shown in Table 1. Turbidity and suspended sediments were also sampled. Results of this sampling were turbidity measurements of 1.2 - 2.7 NTU with an average of 1.9 NTU; and total suspended sediment ranged from 0.66 - 2.4 mg/l with an average of 1.3 mg/l (Figure 2.). Idaho does not have numeric criteria for suspended sediment, but for comparison purposes a value of <25 mg/l is considered by Montana to be a high level of protection for aquatic life. This study concluded that river water quality was generally good and well below the threshold of eutrophic conditions. Phytoplankton species were typical of oligotrophic to mesotrophic waters. Periphyton concentrations were well below nuisance levels for aesthetic impairment. Macrophytes were responsible for water quality violations (Washington) for pH and total dissolved gases during the peak of the growing season. There was no significant difference between sample stations for nutrients, suggesting macrophyte occurrence and sediments do not elevate in-stream nutrient loads (Coots and Willms, 1990).

Table 1. Turbidity, Total Suspended Solids, Flow and Sediment Transport in the Pend Oreille River at Newport (Pelletier et al., 1990).

Date	Flow (cfs)	TSS (mg/l)	*Sediment Load (tons/day)	Turbidity (NTU)
7/13/88	8,330	0.71	16.0	2.7
8/2/88	11,800	0.66	21.0	1.2
8/24/88	5,860	1.08	17.1	1.4
9/13/88	10,700	1.43	41.3	2.0
10/5/88	20,000	2.40	129.5	1.7
10/25/88	23,100	1.07	66.7	1.1
11/17/88	21,700	1.30	76.1	ND

*conversion factor = 0.002697

The 1991 study in this four year series, focused on primary productivity of the Pend Oreille River in Washington and selected tributaries. Temperature was measured over a total of five days in July and August, 1990. Average daily temperatures ranged from 21.3 to 23.8°C (70.3 to 74.8°F).

In 1993, an EPA "Summary of Findings" based on the four years of study on the Pend Oreille-Clark Fork Basin, concluded that water quality in the Pend Oreille River is generally good and in the oligo-mesotrophic range of nutrient enrichment (meaning that it has low to medium amounts of nutrients in the water), and that no violation of Washington water quality standards were found (EPA, 1993). [This conclusion concerning standards violations was contrary to the 1990 progress report information.] Other conclusions of the four year investigation were:

- The primary water quality concern on the Pend Oreille River is the proliferation of Eurasian watermilfoil, an invasive and exotic aquatic plant, downstream from Albeni Falls Dam.

- Approximately 75% of the external nitrogen and phosphorus loading to this reach of the river comes from Newport wastewater treatment plant, Calispell Creek, and Trimble Creek, all in Washington.

- Nonpoint sources of pollutants in the Pend Oreille River basin that potentially affect the river include confined animal feeding operations, agriculture, on-site sewage disposal, stormwater and highway runoff, forest practices, land development, landfills, and gravel extraction.

The recommended management objective of the plan for the Pend Oreille River was:

Improve Pend Oreille River water quality through macrophyte management and tributary nonpoint source controls. [This management plan goal of improved tributary nonpoint source controls has not yet been realized. The Cocolalla and Hoodoo watersheds are listed as water quality impaired and scheduled for TMDL development by the end of 1999.]

During 1991 and 1992, DuPont conducted a study of fish habitat and the effects of drawdowns in the Pend Oreille River. He concluded that drawdown has negative effects on fishes that prefer low velocities and shallow depths. Drawdowns force fish into the main river channel where unfavorable conditions exist and the increased erosion due to drawdowns result in loss of gravel bars and larger substrate. Over-wintering habitat for these fishes (centrarchids) is a limiting factor for the population. As an example, only 4% of the summer largemouth bass habitat are available during winter drawdowns. DuPont concluded that, if the annual drawdown were limited to 6.6 feet (2.0 m) instead of the normal 11.5 feet (3.5 m) drawdown, habitat for largemouth bass would increase 7.5 times in area. Temperature data were also collected as a part of this study (Figure 3.). Temperatures in the main river channel reached a daily average high of 22.5°C (72.5°F) both years in August. Daily average temperatures during high pool (June-August) averaged 19°C (66°F) (DuPont, 1994).

The Pend Oreille Public Utility District is applying for a Federal Energy Relicensing Commission license to continue operation of the Box Canyon dam hydroelectric facility located on the Pend Oreille River near Metaline Falls, Washington. One study in progress is examining temperature of the river versus temperature of its source water, Lake Pend Oreille. Preliminary findings indicate that temperatures of the river from Newport to Metaline Falls are not significantly different than the temperature of Pend Oreille Lake. The conclusion is that temperature exceedences on the Pend Oreille River are due to natural causes (personal communication J. Parodi, 1999). The draft report of this study is expected by fall 1999.

Corsi et al. reported that the Albani Falls Dam significantly effects beneficial uses of the river. The dam restricts upstream movement of migratory fish, and the fluctuating lake levels restrict fish access to tributary streams. Elevated dissolved gas levels during spring high flow periods, and habitat modification as a result of the dam, impact native fish populations. Dams can also isolate fish populations and eliminate life history forms, particularly fluvial and adfluvial forms. Dams can also change water quality (temperature, sediment, and nutrients), water quantity, reduce shoreline food sources, and a direct loss of fish into water conveyance systems (turbines, spillways, or water delivery systems). The Albeni Falls dam and its operations may have negatively influenced overwintering habitat for bull trout, and the dam fragments habitat believed to be historically occupied by bull trout. Low winter water levels are hypothesized to be the primary cause for the decline of kokanee salmon in the Pend Oreille Lake since the late 1960s, because the lower lake levels forced kokanee to spawn in shoreline gravels with high levels of fine sediments (Corsi *et al.*1998). High temperatures in the Pend Oreille River preclude its use by cold water fish.

The Idaho Fish and Game requested that the Power Planning Council raise the winter lake level by four feet, on an experimental basis, to create more kokanee spawning habitat. Another benefit of the increased lake level is that warm water fish habitat in the Pend Oreille River would be increased by more than seven times the regular winter pool level. The new higher level was approved and implemented during the winters of 1996-'97, 1997-'98 and 1998-'99. Idaho Fish and Game has requested seven more years of the higher winter pool level to complete their study.

Results from other information sources concerning the Pend Oreille River were:

*The USGS monitoring station at Newport reports daily discharge amounts only, and therefore no data from this source were available.

*Idaho DEQ's Large River Waterbody Assessment Guidance was determined to be unusable for Pend Oreille River due to its reservoir characteristics and size, and therefore, data collected as a part of the Beneficial Use Reconnaissance Project's 1998 investigation cannot be used to assess the support status of this river (C. Grafe, IDEQ, personal communication 1998).

3. c. Data Gaps For Determination of Support Status

Data gaps that exist for the Pend Oreille River are as follows:

1. No data exist that describes the extent that recent urban development has had on increased sedimentation to the Pend Oreille River.

2. No studies are available concerning the effects of the Albani Falls dam and sedimentation of the river.

3. DEQ has not yet developed a method to determine the support status of the Pend Oreille River.

4. Problem Assessment Conclusions

The river was listed in the 1996 Water Quality Status Report as water quality impaired for sediment, thermal pollution (temperature) and flow.

Temperature

The current temperature standard for the Pend Oreille River protects cold water biota that existed in the river on or after November 28, 1975. There are no data that suggest that temperature has further impaired cold water biota after that date.

Sediment

Uses of the river that must be protected from sediment pollution are cold water biota, domestic water supply and agricultural water supply. The Albani Falls dam and its operation is the major cause of sedimentation in the river. Historically, the increase of bottom sediment has impaired cold water biota in the river, but there is no evidence that the level of impairment has increased since 1975. Total suspended sediment and turbidity are very low and supportive of all designated beneficial uses.

Flow

DEQ at this time does not recognize flow as a pollutant so it was not addressed in this assessment.

In summary, the findings of this problem assessment remain inconclusive until DEQ develops a method to assess the support status of cold water biota in the Pend Oreille River. No evidence was found that indicated cold water biota has been further impaired since 1975.

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